



A Two-Dimensional Electron Gas at the Spinel/Perovskite Interface of γ - $\text{Al}_2\text{O}_3/\text{SrTiO}_3$ with Carrier Mobility Exceeding $100,000 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$

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A Two-Dimensional Electron Gas at the Spinel/Perovskite Interface of $\gamma\text{-Al}_2\text{O}_3/\text{SrTiO}_3$ with Carrier Mobility Exceeding $100,000 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$

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The discovery of two-dimensional electron gases (2DEGs) at the heterointerface between two insulating perovskite-type oxides, such as LaAlO_3 and SrTiO_3 [1], provides opportunities for a new generation of all-oxide electronic devices [2]. Key challenges remain for achieving interfacial electron mobilities much beyond the current value of approximately $1000 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$ (at low temperatures). Here, we create a new type of 2DEG at the heterointerface between SrTiO_3 and a spinel $\gamma\text{-Al}_2\text{O}_3$ epitaxial film with compatible oxygen ions sublattices [3]. Electron mobilities more than one order of magnitude higher than those of hitherto investigated perovskite-type interfaces are obtained. Particularly, electron Hall mobilities as large as $1.4 \times 10^5 \text{ cm}^2\text{V}^{-1}\text{s}^{-1}$ and n_s as high as $3.7 \times 10^{14} \text{ cm}^{-2}$ at 2 K is obtained at this spinel/perovskite complex oxide interface [3]. The spinel/perovskite 2DEG, where the two-dimensional conduction character is revealed by quantum magnetoresistance oscillations, is found to be strongly coupled to interface-stabilized oxygen vacancies confined within a layer of 0.9 nm in proximity to the interface. Our findings pave the way for studies of mesoscopic physics with complex oxides and design of high-mobility all-oxide electronic devices.

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